THE ROYAL MILITARY COLLEGE OF SCIENCE

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Foreword

The purpose of this booklet is to sketch the development of advanced scientific and technological training in the Army and to illustrate the role of the Royal Military College of Science in this field.

Most young men who wish to become officers in the regular Army do so through the Royal Military Academy, Sandhurst, to which they go from their schools. In the two years they spend at Sandhurst as officer cadets about half their time is devoted to military training and half to academic studies. At the end of this period at Sandhurst the majority of officer cadets are commissioned as officers into one of the combatant arms. These are: Household Cavalry, Royal Armoured Corps, Royal Artillery, Royal Engineers, Royal Corps of Signals, Foot Guards, Infantry, Royal Army Service Corps, Royal Army Ordnance Corps, and Royal Electrical and Mechanical Engineers.

Every officer must be trained for the duties of his arm or corps and Arms schools exist for this purpose. Such training today is bound to include some study of science, but for a considerable number of officers much more is necessary than can be provided in this way. More advanced study is required for these officers both to develop mental qualities and to have the scientific preparation necessary for understanding the basic principles of their equipment. For this purpose, selected officers are sent during the first few years of their service to the Royal Military College of Science where they read for degrees of the University of London in science or engineering. The life of a young officer at the College differs in some respects from that of an

undergraduate at a university. He wears uniform, for example, and spends part of one or both of his long vacations on military duties. For his three years at Shrivenham, however, the similarities between his way of life and that of a normal undergraduate are more apparent than the differences. On qualifying for his degree he resumes the life of an officer in the Army.

At a higher level, the Army needs Technical Staff Officers who are complementary to its General Staff Officers. It is a second major function of the College to prepare officers of the British Army and of Commonwealth countries to carry out Technical Staff duties. Such officers come to the College in their late twenties or early thirties, after considerable experience in the Service, to take the Technical Staff Course. The syllabus of this course includes a considerable amount of basic science in its earlier studies in the design of equipment. Studies in general staff duties form an essential additional part of the instruction. On completing the course the Technical Staff Officer may be employed in one of a large range of activities, which include service at a specialist research and design establishment, in the War Office in connection with the study of future equipment for the Army, as a member of the staff of an Army commander, or as a member of a mission abroad. His staff appointments, like those of the General Staff Officer, alternate with periods of regimental duty, for he must on no account lose touch with the Army and it is essential that he should keep his interests as an active member of his arm or corps.

For the two main types of instruction described above, the College has a full instructional staff and an extensive range of equipment. It is therefore possible also to provide specialist courses at a high level in Guided Weapons and Nuclear Science and Technology. These are designed for suitably qualified officers of the three fighting Services and for civilian scientists and engineers.

A short course is also held at Shrivenham for officers who are to attend the Staff College, Camberley. It is complementary to the instruction given at Camberley and its chief object is to instil some understanding of the many technical factors which affect the design, supply and maintenance of equipment. Finally, study periods are arranged for senior officers of the fighting Services and the Civil Service.

This wide range of instruction can only be satisfactorily carried out against a background of advanced study and research by the individual professors and lecturers, whether they are civilians following normal academic careers or military directors of studies holding appointments for a comparatively brief part of their Service careers. The background of study and general culture, together with the range of academic facilities available, such as laboratories and a large library, make it possible to compare the atmosphere of the College with that of a university. Four officers' messes, the equivalent of halls of residence, together with generous provision for the pursuit of sport of many kinds, and the position of the College in an attractive and beautiful part of the country help to strengthen the comparison.

The Army offers more than a profession. It is a calling which requires a high degree of personal dedication and it is probably true to say that it will always ask for more than it gives. To those willing to accept the demands it makes, however, and to devote themselves wholeheartedly to it the Army has always brought many rewards of adventure, travel and friendship. This booklet aims to show that, in addition, the Army can offer the very best of scientific and technical training at the Royal Military College of Science at Shrivenham. The young man with a bent towards science or engineering can therefore use his abilities to the full and at the same time enjoy the other advantages which a career in the Army can bring.

The first two sections of this booklet give a brief summary of the way in which science has become of increasing importance to the Army and sketch the development and functions of the Royal Military College of Science. The third section is designed to show in outline the scientific and technological training which the College can offer to the Army officer, and the fourth describes in some detail the syllabuses of the various courses and the laboratory and other facilities which are available. The last section contains general information about life at the College which in many respects resembles that at any residential university.

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Science in the Army; The Early Years

As its name shows, the Royal Military College of Science exists to serve the Army as a centre of scientific study. Officers are trained in pure science and technology with the object of making them capable of understanding the scientific and engineering problems presented by modern warfare and of applying their military knowledge to help those responsible for the design and development of weapons and equipment in a way that will ensure that practical military requirements are met. In addition, the College is intended to act as a centre of knowledge and reference on scientific and technological matters in general and especially on their applications to war.

Increased emphasis since the last war on the need for the scientific training of Army officers has led to the rapid and continued development of the Royal Military College of Science, which was re-established at Shrivenham in 1946. It would, however, be a mistake to assume that science has only recently begun to be of value to the Army officer. Almost 250 years ago the Royal Artillery realised that the increasing importance of the gun called for an organised system for constructing and

proving artillery pieces and equipment. By the last quarter of the eighteenth century the Military Society of Woolwich had been founded to promote the scientific study of gunnery. Its life was short but the tradition it established resulted in a high standard of equipment by the time of Waterloo. During the period 1780–1890 many Army officers made distinguished contributions to science which were recognised by the fact that at least forty became Fellows of the Royal Society and one, General Sir E. Sabine, became its President.

In 1840, the Army's increased interest in education was shown by the foundation of the Royal Artillery Institution for the study of science and modern languages. The Institution, which was housed at Woolwich, was to become in 1864 the home of the new Advanced Class. This Class was designed to provide two years of organised instruction for Royal Artillery officers, and continued in existence until 1940. Those who successfully attended the course were awarded the qualification 'passed Advanced Class' which is held by several distinguished officers who are still serving.

The Advanced Class was the true beginning of the Royal Military College of Science. In 1885, the Class was transferred to the new Artillery College, which was renamed the Ordnance College in 1899. After the 1914–18 War the College reverted to its old title of Artillery College and was considerably extended. The extension of its work beyond gunnery to other subjects, and in particular to electrical communications and mechanically propelled vehicles, was recognised by its being named the Military College of Science in 1927.

In addition to the distinguished soldiers who have been associated with the College, there have been numerous eminent members of the academic staff. The first Professor of Mathematics, the Reverend W. F. Bashforth, was known as 'the father of modern gunnery' and among his successors Sir George

Beckett Hall, one of the four halls of residence.

Students at work in the drawing office.

The Royal Military College of Science Today

The 1939–45 War demonstrated to any doubters the vital importance to the Army of using the fruits of scientific and technological developments. Before the War had ended, plans were on foot to re-establish the Military College of Science in a much more ambitious form than had ever been imagined before the War, and the culmination of these plans was the reorganisation which took place in 1946. The Advanced Class, which had catered chiefly for gunnery, was replaced by the Technical Staff Course which provided instruction for officers of all arms of the Home and Commonwealth land forces. This course was divided into three groups which provided specialist instruction in weapons, fire direction and fighting vehicles respectively, together with the study of staff duties. Other courses at a higher level were introduced to provide specialised instruction for officers of all three Services, and short courses for non-specialist staff officers followed.

The most striking innovation was, however, the decision to provide degree training for many more young officers. In 1946, the University of London approved the College as a suitable

institution to give instruction to external candidates for its degrees, and the College now caters for over 200 students being prepared for degrees. Most of these are young officers from Sandhurst, but an important, if small, section consists of civilian students. These are awarded studentships by the War Department under a scheme which was founded by the former Ministry of Supply and which is still not widely enough known. The majority of degree students prepare for the degree of B.Sc. (Engineering) in Civil, Mechanical or Electrical Engineering. A smaller number read for the B.Sc. (General) degree, which covers Mathematics, Physics and Chemistry, and a few take the B.Sc. (Special) degree in one of these three subjects.

The place of the Royal Military College of Science in the career of the Army Officer

When he leaves the Royal Military Academy, Sandhurst, the young officer with the necessary scientific qualifications may enter, and is encouraged to enter, the Royal Military College of Science. These qualifications are usually the General Certificate of Education at advanced level in Mathematics and Physics and at ordinary level in Chemistry, as prescribed by the University of London for entrants to engineering and science degree courses. Frequently he will first be required to perform a period of regimental duty before attending at Shrivenham, but some young officers, particularly those from the technical corps, may be sent direct from Sandhurst. At Shrivenham the officer lives a life which has much in common with that of the normal undergraduate who is resident in a university. The wearing of uniform on most working days distinguishes him from the civilian student, but the instruction in the form of lectures, practical work and demonstrations in laboratories and workshops, is the same as that given to students reading for similar degrees elsewhere. This instruction naturally has no military flavour, but the officer has the opportunity of maintaining touch with his regiment or corps by suitable attachments during one or more of the long vacations. Formal instruction fills about twenty hours of the working week and the student is expected to devote adequate time to the private study

necessary for success in examinations. This he can do and still enjoy the extensive sporting and cultural facilities to the full, as is shown by the success which members of the College achieve in both academic and extra-mural activities. Upon successful completion of his degree course the student returns to regimental duty with a valuable qualification, useful scientific and technical experience, intellectual training for the future and, in the case of a man with a first or second-class Honours degree, a bonus in the form of qualification pay at the rate of 3/6 a day for a Lieutenant and 6/– a day for a Captain. Officers of outstanding academic ability may be allowed to stay at the College or to return later and carry out research towards higher degrees.

As has already been briefly explained, the Technical Staff Course is designed for the older officer between the ages of 28 and 32, who may or may not have attended a degree course. The complete course lasts for two years and a term, and is open to officers who can provide evidence of ability to reach the level required for the award of the qualification 'passed Technical Staff Course'. Officers with science or engineering degrees join towards the end of the first year of the course. This year is largely devoted to fundamental instruction which should have been already covered by the graduate. The remaining eighteen months are spent in studying the effect of scientific and technical considerations on military weapons and equipment, to the learning of staff duties and finally to participation in a lengthy design study. This last involves the assessment of a military requirement, whether weapon, fighting vehicle or fire direction equipment, and the design of the equipment to meet that requirement, taking into account practical considerations of use, manufacture and finance.

The Technical Staff Officer who intends to specialise in Guided Weapons may later attend a Guided Weapons course which lasts for three terms and provides him with the specialised

knowledge necessary for some of the more technical appointments in this field which the Army has to fill. Successful completion of this course exempts the officer from the examination for the Associate Fellowship of the Royal Aeronautical Society.

The rapid increase in importance of nuclear science and technology was recognised some years ago by the introduction of a specialised course in this subject. The Technical Staff Officer, as a normal part of his course, receives basic instruction in nuclear science, and the specialised course is intended to cover more fully the military aspects of the subject and the rapid technological developments which are taking place. This course involves intensive study and has recently had to be extended in length in recognition of the ever-widening field of nuclear science. Degree students, including those from Cambridge, attend a short introductory course in this subject.

The College also caters for the basic scientific instruction of the officer who attends the General Staff Course at Camberley. This is given by means of a three-month course which is designed to create an awareness of the impact of scientific and technological developments on war.

Other courses of varying length are given from time to time to meet military requirements, and the officer who reaches the rank of Brigadier or Major-General may find himself attending a study period at the College.

All this shows the importance attached to scientific training in the Army of today and the contribution made by the Royal Military College of Science towards providing the scientific and technological education which modern circumstances demand. The young officer with a scientific bent can see that he is assured of ample opportunity to develop and exercise his talents, and the officer with a restricted scientific background can acquire a valuable general knowledge of the implications of science for both the citizen and the soldier.

How the Royal Military College of Science works

This section is in two main parts; in the first the courses are described, while in the latter the organisation of the academic departments and military divisions is set out in detail for those readers who are interested.

The academic instructional work in the College is carried out in four academic departments. These are staffed entirely by civilians, and the academic staff alone numbers over 70, of whom 7 are professors and 13 are associate professors. The teaching of degree students is entirely the responsibility of the Departments, as is most of the purely academic instruction of other courses. The military applications of science and technology, training in staff duties and similar types of instruction, are the responsibility of three military divisions which are headed by Colonels and staffed by over 20 military officers. The academic Departments and the military Divisions interlock and maintain close day-to-day contact to ensure the co-ordination of all types of teaching. The College as a whole does not work in isolation but is in constant touch with the Ministry of Aviation, the Admiralty, the Air Ministry, the universities, industrial and research establishments, and, within the Army, with the Staff College at Camberley, the Royal Military Academy, Sandhurst, and the Arms Schools. The Royal Military College of Science thus acts as an invaluable link between the Army and the world of teaching and research and fulfils its function as a centre of study and information concerning the applications of science to military matters.

The following paragraphs show the scope of the main courses held at the College and the functions of the academic departments and military divisions in providing the instruction.

COURSES

LONDON UNIVERSITY EXTERNAL DEGREE COURSES

(three years)

Students study for the following degrees:

B.Sc. (General)	An honours degree course. The successful candidates must pass examinations in Mathematics, Physics *and* Chemistry.
B.Sc. (Special)	An Honours degree course in Mathematics, Physics *or* Chemistry.
B.Sc. (Engineering)	An Honours degree course in Civil, Mechanical *or* Electrical Engineering.

The syllabuses of the courses and the regulations for the examinations in the above branches are laid down from time to time by the University of London.

TECHNICAL STAFF COURSE *(two years and one term—three terms less for graduates in science or engineering)*

This course, which leads to the qualification 'passed Technical Staff Course' is intended as a parallel to that for General Staff Officers ('passed Staff College') at the Staff College. Selected officers between the ages of 28 and 32 from the British and Commonwealth Forces are prepared for duties as Technical Staff Officers in the Home and Commonwealth Armies. The object of the training is to fit officers of considerable military experience to assess the design of all forms of military equipment from the point of view of the user. An understanding is required not only of the basic features of the design of a piece of equipment, but also of the specifications for its manufacture, of its inspection, of the measurement of its performance, and of

its maintenance in service. Training in staff duties is also essential to this work. The nature of this and the courses described below call for extensive instructional facilities. Some idea of the range of these is given by a mention of some of the subjects dealt with: nuclear science and technology, ordnance, small arms, fire control equipment, ammunition, explosives, pyrotechnics, chemical warfare, radar and telecommunications, guided weapons, computers, ballistics, all tracked and wheeled military vehicles, mines and engineering equipment for bridging and earth moving.

GUIDED WEAPONS COURSE (*one year*)

The Guided Weapons Course is at advanced level and is designed to supplement the knowledge gained on Technical Staff and degree courses. It covers the whole field of guided weapons, including structural and chemical problems involved in design and the principles and application of aerodynamics, guidance, missile control, propulsion and fusing. Practical experience is gained on visits to firms producing guided weapons or associated equipment and also by the execution of an actual design exercise. Suitably qualified officers of the other Services and the Commonwealth countries are eligible to attend, as are also civilian scientists and engineers employed in Government departments.

NUCLEAR SCIENCE AND TECHNOLOGY COURSE (*20 weeks*)

This course is at a similar level to that of the Guided Weapons Course. Particular stress is given to technological developments in the nuclear field and the aspects covered include the principles of nuclear fission and nuclear energy, the problems involved in construction of nuclear weapons and nuclear reactors, and study of the blast, radiation and heat effects of nuclear

explosions. Practical experience is gained by visits to firms or establishments, including Harwell and Aldermaston, and to appropriate military units and formations.

GENERAL STAFF SCIENCE COURSE (*three months*)

This is a short course for officers who are to attend the General Staff Course at Camberley, and is designed to give an appreciation of the scientific and technological background of modern strategy and tactics.

AMMUNITION TECHNICAL OFFICERS' COURSE (*20 weeks*)

The College instructs Royal Army Ordnance Corps officers in the basic science, particularly the chemistry, of fuels and metallurgy, which they are required to possess before they can qualify to become Ammunition Technical Officers. This instruction is an integral part of a longer course which is held under the auspices of their own corps.

RESEARCH

Advanced instruction can only be given effectively against a background of basic and applied research. The members of the academic staff of the College devote a large part of their time and energy to research and advanced study, the results of which may be published in the journals of the learned societies, may lead to improved instructional equipment or may appear as internal reports and projects. The military instructional staff are primarily concerned in their studies with the development of future Army equipment.

From time to time outstanding degree students may be allowed to carry out research towards a higher degree under the supervision of the head of the department concerned with the subject of their studies.

THE ACADEMIC DEPARTMENTS

These number four; Mathematics and Physics, Chemistry and Metallurgy, Civil and Mechanical Engineering, and Electrical and Instrument Technology. Under these broad headings instruction is divided into thirteen branches.

DEPARTMENT OF MATHEMATICS AND PHYSICS

Mathematics Branch

A knowledge of mathematics is fundamental to all scientific and technological study and the necessary instruction is given to all students according to the requirements of their course. In addition to the normal work of teaching mathematics to students reading for degrees in Mathematics, Engineering and General Science, the branch provides a basic course in mathematics for the Technical Staff Course in its first year. Second-year Technical Staff students are given a course in statistics and courses are also provided for students specialising in electronics and guided weapons.

Physics Branch

In addition to the normal programme of a university physics department in preparing candidates for the B.Sc. (General) and B.Sc. (Special) Physics degrees, this branch provides courses in pure and applied physics at different levels for other courses, with special attention to nuclear physics. There is extensive laboratory accommodation, including Spectroscopic and Acoustics Laboratories and dark rooms for photometric and photographic work. The Rutherford Laboratory, which is operated in conjunction with the Chemistry Branch, provides facilities for nuclear studies, and the range of equipment in this field is being rapidly increased to keep pace with current developments. A new laboratory, with a high intensity source, serves similarly for studies of the effects of nuclear radiation.

Ballistics Branch

The teaching of ballistics involves both the theoretical and experimental sides of the subject. The work of the branch is therefore closely related to that of the Mathematics and Physics Branches. The experimental accommodation contains equipment for the measurement and recording of pressures, the photography of projectiles in flight, and the measurement of the velocities of projectiles.

The greater part of the instruction is given to students of the Technical Staff and Guided Weapons Courses, and the field covered includes the internal and external ballistics of guns and rockets, stability of shell, dispersion of fire, general aerodynamics and the kinematics of missile trajectories.

DEPARTMENT OF CHEMISTRY AND METALLURGY

Chemistry Branch

Instruction is given in the fundamental divisions of chemistry; physical, inorganic and organic; all these subjects are taught to degree standard and to the first year of the Technical Staff Course. Nuclear chemistry is of special importance, and subjects taught include radioactivity, nuclear reactions, the separation of isotopes and their uses, the chemistry of uranium and fission products, and the chemical physiology of radiation sickness. There are well-equipped laboratories for the practical teaching of these subjects.

Applied Chemistry Branch

This branch is concerned with the application of inorganic, organic and physical chemistry to military problems. The branch deals with the chemical factors affecting military materials of all kinds, in relation to properties, production and handling. The study of the chemistry and technology of

military propellents and explosives is emphasised. Among other specific topics covered are chemical warfare and prophylactic agents as well as fuels, lubricants, plastics, textiles, packaging and protective materials. Particular attention is given to the effects of environmental conditions, including radiation at all levels, on materials used for military purposes. There are laboratories equipped for research, and a wide range of small scale tests.

Metallurgy Branch

The wide subject of metallurgy, from the ore to the final product, is closely linked with chemistry, physics and engineering. It includes extraction, refining, melting, alloying and powder metallurgy; the metallurgical aspects of casting, hot working, cold working, soldering, welding; heat treatment, surface finishing, corrosion, testing and inspection, the investigation of failures, and special Service features. The branch gives lectures and practical instruction and has large collections of samples, slides and films. Some ten laboratories, a workshop and dark room provide the necessary practical facilities.

To provide a valuable general service to the College, the Department also possesses a glass-blowing workshop for the construction and repair of scientific glassware.

DEPARTMENT OF CIVIL AND MECHANICAL ENGINEERING

Heat Engines Branch

The branch is responsible for instruction in the theory and practice of conventional heat engines, of guns and small arms and of rocket motors. The instructional equipment includes a variety of British and foreign engines, steam, gas, oil and petrol, equipped with dynamometers and with full instrumentation for performance tests, an experimental refrigerating

plant, a tubular heat exchanger, different types of air compressor, an experimental heat pump, gas turbines, guns and small arms and a small liquid fuel rocket motor for static tests.

There are research facilities for investigations into fan and compressor design, heat transfer and the combustion of fuel droplets, and active research in these fields is in progress.

Machines Branch

The theoretical and practical study of machines, the design of weapons and vehicles, the study of metrology, and the instructional workshops for the workshop practice carried out by students are the responsibilities of the Machines Branch. A special feature of the work of the branch is the instruction given through the detailed examination and comparative study of the varied British and foreign equipment in the demonstration rooms. There is a wide range of laboratories, workshops and demonstration rooms devoted to such subjects as recoil systems, sighting systems, fighting vehicles, production processes, metrology, weapons, vehicle transmissions, tank armament, tank power trains and so on. Research is in progress into the characteristics of pneumatic tyres in relation to problems of vehicle stability and control, and the machine tools laboratory of the instructional workshops contains a number of machine tools of advanced design for investigations into machining processes.

Mechanics Branch

Instruction is given in applied mechanics, fluid mechanics, including hydraulics and aerodynamics, and engineering drawing. There are three well-equipped instructional drawing offices. The College has developed a special method for the teaching of engineering drawing which is adapted to suit the limitations on time and the differing needs of Technical Staff and other courses. The Applied Mechanics Laboratory is

equipped to illustrate the basic principles of mechanics and the application of these principles. The Hydraulics Laboratory is provided with water circuits supplied with water under pressure by centrifugal pumps and feeding various types of turbines, both the pumps and turbines having full instrumentation for performance tests. Other equipment includes rigs for calibrating venturi meters, orifice plates, notches and weirs, apparatus for testing the resistance to flow in pipes and for measuring the discharge of open channels, a hydraulic ram, a model surge tank installation and various floating models to illustrate stability. The Aerodynamics Laboratory has a low-speed wind tunnel, with facilities for lift, drag and pressure measurements and with a small supersonic wind tunnel, Mach No. 1·6, and Schlieren equipment for observation of shock phenomena. There is a 10-inch × 10-inch shock tube for research purposes.

Materials and Structures Branch

This branch is responsible for teaching the strength, elasticity and other properties of materials, soil mechanics, engineering geology, the theory and design of structures, including guided weapon structures and, for the Technical Staff and other specialised courses, armour and attack on armour.

The branch has two Materials Laboratories which house universal testing machines and other specialised machines for hardness, fatigue, torsion and impact. There is a wide variety of strain gauge apparatus and a photoelastic polariscope.

The Structures Laboratory is chiefly devoted to tests on reinforced and pre-stressed concrete and there is a 50-ton loading frame which was designed and built by the staff and students for the testing to destruction of reinforced concrete beams. The facilities also include a Soil Mechanics Laboratory, a Model Structures Laboratory and a small geological collection.

Research investigations are in progress into the wind-loading on structures, using models in the wind tunnels of the adjacent Fluid-mechanics Laboratory.

DEPARTMENT OF ELECTRICAL AND INSTRUMENT TECHNOLOGY

The Department contains three academic branches which are served by a departmental drawing office and workshop. The workshop consists of three sections: Electrical Engineering, Electronics and Mechanical.

Electrical Engineering Branch

This branch covers all aspects of electrical engineering other than electronics, telecommunications and radar. The main teaching load is that of the B.Sc. (Engineering) courses, but students of most other courses study specialised military applications of electrical engineering.

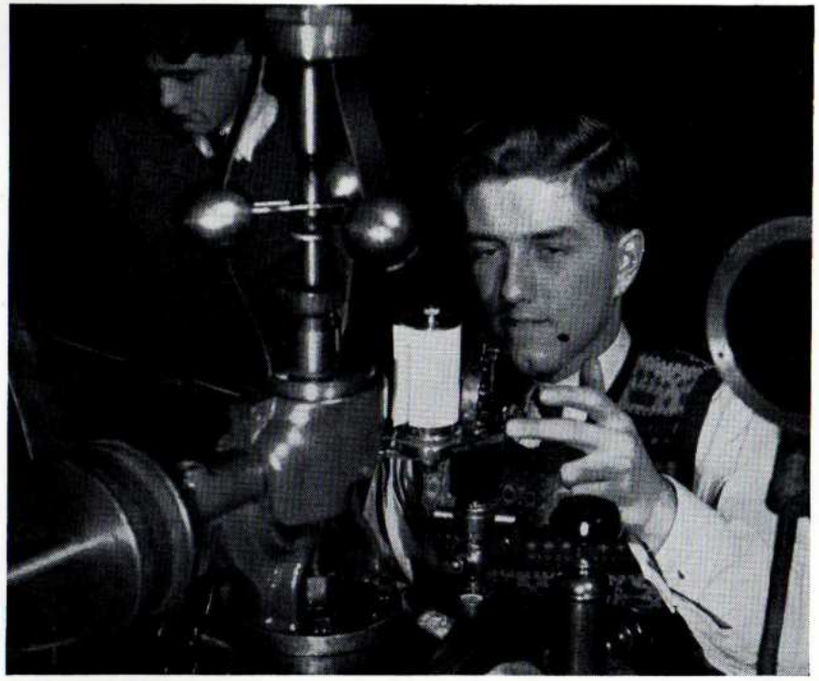
The Electrical Machines Laboratory contains a variety of direct current motors, generators, converters and transformers for experimental work.

The Motor Vehicle Equipment Laboratory provides facilities for experiments on the electrical equipment of automobiles, including special military auxiliaries such as electrical drives for fighting vehicle gun-turrets.

The Basic Laboratory is mainly used for elementary bench experiments and for experiments in illumination.

The Electrical Power Laboratory contains a short-circuit test set, high-voltage D.C., A.C. and impulse test sets, and such power equipment as a grid-controlled mercury-arc rectifier and system protective devices.

The Service Equipment Laboratory contains a variety of electrical equipments used in the Services, including electric servomechanisms, computing devices and data transmission system.



Carrying out a running test on a simple steam engine.

Testing the strength of materials in the laboratory.

Engineering Physics Branch

This branch is responsible for work on general instrumentation, servo-mechanisms and automatic control, analogue and digital computing, guided weapon control, applied optics including infra-red instruments and techniques, gyroscopic instruments and techniques, and fire direction instrumentation.

The laboratories are extensive and well equipped. Students have access to a wide variety of experiments designed by the branch staff and constructed in the Mechanical Section of the Department's workshop.

The servo-mechanisms laboratories are among the pioneering ventures into the teaching of this relatively new and expanding subject from the experimental angle. Most of the experiments are equally suitable for Service or civilian students, since the theory is developed in the lectures from basic principles. There is a wide selection of miniature high-performance hydraulic and pneumatic servo-mechanisms used in guided weapon control systems and specialised recording equipment to measure their performance: e.g. high-frequency pen recorders, oscilloscope recording cameras, transfer function analysers, etc.

Students also perform experiments illustrating analogue and digital computing and conversion techniques.

THE MILITARY DIVISIONS

The Military Divisions number three, and are known as the General, Weapons and Vehicles, and Electronics and Guided Weapons Divisions respectively.

General Division

This Division is concerned with the military applications of Nuclear Science and Technology; it gives instruction in tactics, staff duties and technical intelligence. The Division also studies the broad tactical background for future war.

The Division is responsible in particular for the Nuclear Science and Technology Course for postgraduate students, the General Staff Science Course for Staff College students and graduates, and the Short Staff Course which forms part of the Technical Staff Course.

Weapons and Vehicles Division

This Division studies the application of scientific and engineering principles to weapons and vehicles. It deals with all types of weapons, except guided weapons, and studies those aspects of mobility covering wheeled and tracked vehicles, amphibians, military transport aircraft (in both fixed and rotary wing classes) and aerial vehicles.

The work of the Division is divided into seven specialised sections dealing respectively with infantry weapons, guns, ammunition, power plants, the general design of Army fighting vehicles, weapon mountings (including static, towed and self-propelled mountings) and mobility.

The staff of the Division exercise general military supervision over Technical Staff Course students in the Weapons and the Fighting Vehicles Groups, and over all students on Inspecting Ordnance Officers' Courses.

The Directing Staff of the Division also instruct the Technical Staff, General Staff Science and Inspecting Ordnance Officers' Courses. For this task of instructing in the military applied subjects the Directing Staff lecture on behalf of the academic branches to which they are affiliated.

Electronics and Guided Weapons Division

This Division studies the principles of electronic techniques and their military applications. The work of the Division covers the following subjects: guided weapons, telecommunications

including data processing, control and computing techniques, guidance and radar, combat surveillance. The Division also has a major responsibility in the organisation of the Guided Weapons Course.

The staff of the Division exercise general military supervision over the students of the Guided Weapons Course and those of the Technical Staff Course studying electronics and instrumentation.

The Directing Staff of the Division instruct all courses in the College on the military applications of electronic techniques and guided weapons. They also undertake certain lectures on behalf of the academic staff of the Electrical and Instrument Technology Department.

Design Studies and Exercises

In order to give practice to Technical Staff and Guided Weapons Course students in applying their acquired knowledge to military problems, the final stage of their course involves a Design Exercise. Since the exercises comprise the application of science and technology to military equipment, they are directed by the appropriate Military Divisions.

The Guided Weapons Course and Technical Staff Course students studying weapons and fighting vehicles are generally set exercises involving the writing of military characteristics, and the preparation of an outline design and of a detailed report covering their conclusions. The subject for the Technical Staff Course students is chosen so as to exercise both Weapons and Fighting Vehicles students in their respective spheres. In the final stage the students present their findings to an invited audience and the exercises are completed by a discussion on the technical and tactical aspects of the students' solutions.

The Technical Staff students studying electronics and instrumentation form syndicates of three or four members, each of

which is set a design exercise involving a technical appreciation of a problem followed by the design and construction of a working model. Each syndicate is required to write a report and present its solution to an invited audience.

THE LIBRARY

The College possesses a first-class library of basic reference works and text-books. In addition to the usual printed books and periodicals, there is a large collection of internal publications on special subjects. The Technical Information Bureau provides an information service which is becoming increasingly valuable. An idea of the scope and size of the Library is given by the fact that after the recent removal of obsolete material the stock was found to amount to well over 80,000 books and pamphlets.

Sport, Other Extra-Mural Activities and Social Life

As a community the Royal Military College of Science is unique. It is a military establishment possessing many of the attributes of a university and contains the largest number of resident officers anywhere in the British Service. The buildings in which the College is housed are outstandingly good and their surroundings extremely pleasant. With this background the amenities and sports to be found at Shrivenham are difficult to rival.

The residential accommodation consists of four Officers' Messes, known as Halls. One of these, Beckett Hall, is in a country mansion which was completely rebuilt in the '30s of the last century. The other three are in modern buildings and named respectively after three great British soldiers—Allenby, Roberts and Kitchener. All single students are required to live in during term, and the military and civilian staff of the College belong to one or other of the Halls.

Cultural activities at the College are, in the main, fostered and co-ordinated by an Arts Council. This exists to promote artistic pursuits in the College, to help in the formation of societies for that purpose, to help existing societies when need arises and to provide common facilities such as stage lighting, costumes and so on for any of its member societies. It supervises the Arts Centre, with its theatre-cum-concert hall, and constantly seeks to improve this.

Among the societies connected with the Arts Council are the Art Society, the Beckett Park Photographic Society and the Debating Society. There are flourishing Choral and Orchestral Societies which perform publicly, usually jointly, on several occasions during the year. The College Dramatic Society is active and progressive. Plays are frequently performed publicly in the College theatre and play readings are a regular feature.

Practically every form of sport is catered for, and individual clubs are all affiliated to the College Athletic Union. There are at present 21 active clubs which provide facilities for members to play all the more popular games, such as both kinds of football, cricket, hockey, golf, squash, badminton and lawn tennis. There are also angling, archery, fencing, mountaineering, motor sport, sailing and boat clubs, and those who wish to shoot can join the gun club or the rifle club, or both.

It is the policy of the Athletic Union to do everything to develop and support the athletic activities and to maintain the standard of teams at a level appropriate to a university college. Much has already been done in this respect, and club lists contain attractive fixtures with such clubs as the Greyhounds, Centaurs, Authentics and Divots of Oxford University, and the LX Club of Cambridge University, as well as other universities, the Royal Military Academy, Sandhurst, and strong Corps sides. The Union runs a well-stocked sports shop which provides all kinds of sports equipment at attractive prices.

The Saddle Club is well supported and members can hunt with the Old Berkshire and the Vale of White Horse (Cricklade) Hunts.

In the fourteen years since the College was established at Shrivenham, much has been done to bring the College grounds towards maturity. The sports grounds are improving in quality every year and there is a 9-hole golf course which is maintained

at a very satisfactory standard. These features, together with the careful planting of trees and reafforestation on the estate generally, preserve and even enhance the rural character of the setting.

Miscellaneous facilities

Besides artistic and sporting activities, social interests are catered for. There are bridge and chess clubs, and wives of staff and students can join their Hall Wives Club. The Berkshire Education Committee has been good enough to permit the establishment in the College of a branch of the Berkshire Lending Library, and there is a fine modern cinema which was erected by the Army Kinema Corporation several years ago.

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